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ABSTRACT

This ERIC digest provides a brief overview of the video, audio, and computer technologies that are currently used to deliver instruction for distance education programs. The video systems described include videoconferencing, low-power television (LPTV), closed-circuit television (CCTV), instructional fixed television service (ITFS), and cable television (CATV). Several types of audiographic teleconferencing are then described, including telefacsimile (FAX), freeze-frame or slow scan video, and compressed video. Audioconferencing is cited as the principal use of audio telephone delivery, but it is noted that other options are also available, including the use of an audio bridge to enable two-way interaction among groups at three or more locations. Computer conferencing options are also described, including electronic mail networks, electronic bulletin board services (BBSs), and teletext and videotex. A brief discussion of distance education concludes the digest. (14 references) (EW)

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DELIVERY SYSTEMS FOR DISTANCE EDUCATION

by Linda Schamber

Distance education is defined as an educational system in which the student is formally enrolled in a school or college but receives instruction at some remote site. Traditionally, correspondence has been the primary delivery medium; however, the delivery systems most common today are based on video, audio, and computer technologies. An interesting facet of these technologies is that they have been adapted to transmit information in unexpected forms: visual images via telephone lines, for example. A variety of such adaptations make live transmission of lectures, demonstrations, and audiovisual resource materials possible, often in an interactive context.

Video Delivery

Video information can be transmitted at least six ways: by radio broadcast frequency, telephone line, coaxial cable, satellite, microwave, and optic fiber. A commercial communications satellite maintains a position 22,300 miles in the sky, offering continuous line-of-sight contact with each station sending and receiving signals. Microwave relays are often the "final mile" links from satellite relays to destinations, transmitting where satellites don't. Microwave towers at line-of-sight intervals can also serve as primary stations, transmitting one-way and two-way video and audio. Optic fiber is a hair-thin glass tube that can transmit light less expensively and more accurately than copper wire. Video communications systems vary in their capabilities.

Videoconferencing is a full-motion, full-color system whose one-way or two-way video portion may be transmitted by satellite, and whose two-way audio portion is also carried by satellite or on telephone lines. This system permits a range of information forms, including videotape, film, graphics, slides, and data. It is a good medium for drama, demonstrations, and simulations. It is also costly, to the point that links to as many as 30 locations are required in order for it to be economically feasible. Communication with multiple sites in turn hampers or prevents two-way audio communication. Satellite transmission is useful for national organizations, especially those with large and homogeneous memberships

Low-power television (LPTV) depends on a 1- to 5-kilowatt broadcast signal that covers 10 to 20 square miles. It is relatively low in cost and often used in rural areas.

Closed-circuit television (CCTV) is a private hard-wired system often used on campuses.

Instructional fixed television service (ITFS) uses microwave technology for one-way or two-way audio and video transmissions that cover a radius of 25 miles. ITFS networks use channels reserved by the FCC for educational and cultural programming. Receiving sites must have appropriate antennas and downconverters.

Cable television (CATV) offers two-way communication for institutions that want to send local programming to the cable station. The information is then distributed to the community by way of special access channels on the normal cable system.

Television is the most attractive, complex, and expensive delivery system; its use requires a strong commitment on the part of educational administrators and public television personnel.

Audiographic Delivery

Audiographic teleconferencing is the transmission of still image and audio signals over telephone lines.

With an **electronic blackboard**, the image is drawn or written on a pressure-sensitive surface that converts the writing to audible telephone tones. A relatively inexpensive decoder at the receiving site converts the signal for display on a special screen. The instructor's voice is transmitted over a second telephone line and amplified in the classroom. Two-way audio allows students to interact with the instructor. Telewriters and electronic pens and tablets are variations on this technology.

Telefacsimile (facsimile, FAX) is a low-cost means of sending paper copies of documents using telephone lines. A page is scanned by a FAX machine at one end, transmitted, and printed at the other end in about 45 seconds. The cost, after the initial equipment investment, is that of the telephone call. FAX is used for important, high-quality images such as contracts, design plans, and graphics. FAX machines can also interface with microcomputers and can double as copy machines.

Freeze-frame or slow scan video can best be described as an electronic slide show transmitted by telephone lines. A narrow-band frequency transmits video over one line; audio over another. Transmission takes a few seconds to more than a minute.

Compressed video uses a telephone data circuit. The video signal is compressed by a picture processor to eliminate redundant electronic information. A moving video signal appears instantly at the receiving end, but rapid motion may be jerky or blurred.

Audio Telephone Delivery

Telephone lines have long allowed audioconferencing, i.e., two-way voice communication among several people using a simple telephone amplifier. Voice-only conferences can use public lines or dedicated leased lines. Participants may want to supplement audio with visual material sent by facsimile, electronic blackboard, or materials sent by mail before the teleconference.

Touchtone phones have a **direct-dial** option for small conferences of individuals.

For two-way interaction among groups at three or more locations, an **audio bridge** may be necessary. A telephone company will provide the service at an hourly rate. Additional costs are high-quality speaker phones and long-distance telephone rates.

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Computer Delivery

Computer teleconferencing is the transfer of information from one computer to another. A modem is necessary to convert signals for sending over telephone lines. Participants at any number of sites can engage in live interaction by entering messages at the keyboard and reading messages as they appear on the screen. Messages can also be held by the computer until the user checks in. Information can be text, graphics, or data, but not audio.

Electronic mail networks provide communication among designated groups, and also permit individual two-person communication. These systems, which can be local, national, or international, usually charge a use fee, although an educational institution may pick up all or part of the cost for faculty and students.

Bulletin board services (BBSs) provide a means for users to post messages and to download other messages to their own computers. Literally thousands of BBBs exist, most of them free. An individual teacher can set up a bulletin board for exchange of schedules, assignments, and tests. Some public BBSs focus on education, and large-scale information utilities such as the Source and Compuserve offer special-interest BBSs as part of a subscription fee. Online database vendors also offer electronic mail and BBSs.

Teletext and **videotex** turn the television set into a terminal to receive still video images from a database stored in a computer. Signals are transmitted via telephone lines or cable. A decoder is required to display information in the usually unseen vertical blanking interval of the television screen. Teletext is often described as one-way and videotex as two-way communication. The information appears in the form of "pages" of color text and graphics. Existing networks offer educational material, news, home shopping services, and travel and entertainment information.

Information systems that integrate computers with new technologies are rapidly being developed. For example, microcomputers can be linked to laser readers that access information stored on optical disks. Optical disks such as CD-ROM can store large databases, and interactive videodisks allow manipulation of still and moving video images. These new technologies allow users to exchange large quantities of information as well as to communicate directly with each other. Still other more traditional delivery systems, such as radio transmission and postal services, continue to exist and sometimes to support the newer technologies.

Distance Education Programs

For educational institutions, distance education can mean wide dissemination of information, links with the community, and optimal allocation of resources. For students, it can mean opportunities for continuing education, often for those who are unable to attend conventional courses because of distance, cost, time, or physical incapacity. Seminar and conference participants benefit from a flexible format and a high level of interaction without the time and expense of travel.

Distance education can be expensive, however, and it requires careful planning, management, and course design. When choosing a delivery method, the institution must also consider whether the system can reach its intended audience and provide better instruction than the traditional teacher. It helps to study existing programs, many of which cover the larger and more rural states, such as Alaska. These programs often take the form of inservice training or university credit courses, and are directed to agriculture, health, and social work professionals. Canada, Australia, parts of Western Europe, and the Soviet Union are active in distance education, and in developing countries around the world it is a mainstay.

For those interested in starting a distance education program, an excellent reference is the *Minnesota Technology Resource Notebook* (Telecommunications Development Center of the Minnesota Extension Service, 1986). Intended to encourage use of new technologies in the delivery of outreach education, it contains tables for media selection; descriptions of national and state resources for video, audio, and computer technologies, and for traditional audiovisual classroom materials; directories of resources such as videodisks and audiotapes; and 70 case studies of higher education institutions. It is available for $15 from the Distribution Center, Minnesota Extension Service, 3 Coffey Hall, 1420 Eckles Ave., St. Paul, MN 55108.

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